Plug-in Electric Vehicles

Over 26 million cars and almost one million trucks consume 40 million gallons of gasoline and 7 million gallons of diesel each day in California, totaling $187 million in daily fuel expenditures. The Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP), authorized by Assembly Bill 118 (Nunez, Chapter 750, Statutes of 2007), strategically invests $100 million in public funds each year to promote the development of a clean and secure transportation future. Investments in alternative and renewable fuels, advanced technology cars and trucks, vehicle manufacturing, and fueling infrastructure are intended to build a strong manufacturing base, develop a skilled workforce, and reduce the state's reliance on petroleum-based fuels while improving air quality and reducing greenhouse gas emissions. To date, the Energy Commission has partnered with alternative vehicle and engine manufacturers, battery manufacturers, alternative fuel producers and fueling infrastructure providers, utilities, universities, transit and air quality districts, and cities and counties to help realize these goals.

On March 23, 2012, Governor Brown signed an Executive Order laying the foundation to support 1.5 million zero-emission vehicles (ZEVs) by 2025. ZEVs include all-electric vehicles, plug-in hybrid vehicles, and fuel cell electric vehicles. As a near-term goal for 2020, the Executive Order specifies infrastructure be built to support the fueling of 1 million zero-emission vehicles.[1] In addition, the governor has recently published a Zero Emission Vehicle Action Plan which specifies clear action items to promote the building of fueling infrastructure, increase vehicle adoption, and the development of ZEV-related California jobs.[2]

Investments from the ARFVTP have allowed California to start on a path to meet the ambitious goals of the Zero Emission Vehicle Action Plan. By establishing regional planning activities, participating in the development of the 2013 Zero Emission Vehicle Action Plan and setting up a strategic electric vehicle charging network, the Energy Commission will help consumers and electric vehicle companies work towards a cleaner, healthier California.

Program investments in the electric vehicle area include:

- Establishing the foundation for a zero emission transportation future through funding of electric vehicle supply equipment (EVSE), contributing to the largest network of electric charging stations in the country.
- Providing funding for advanced technology zero emission and low emission medium- and heavy-duty truck demonstrations and deployment.

1. http://gov.ca.gov/news.php?id=17463

2. http://opr.ca.gov/docs/Governor's_Office_ZEV_Action_Plan_(02-13).pdf

- Providing seed funding for start-ups and small manufacturers of advanced technology vehicles, components and batteries to expand their plants and assembly lines and help make California a hub of electric drive vehicle development, manufacturing and use.

Electric Vehicle Charging Infrastructure

The ARFVTP is supporting the rollout of over 7,100 level 1 (120 volt single phase), level 2 (208 to 240 volt single phase), and direct current (DC) fast charger (208 volt to 480 volt 3-phase input) EVSE throughout California. Level 1 and 2 EVSE are primarily used for extended charging sessions and DC fast chargers are often used on highway corridors. With the initial sales of electric vehicles, the majority are expected to be with single-family detached homes with an installed residential charger. For these vehicles, the charging sessions are expected to be at-home and overnight with supplemental charging at workplaces and commercial and municipal charging sites. ARFVTP funded the following EVSE projects:

- Electric Transportation Engineering Corporation (ECOtality) – The “EV Project” in San Diego for qualified Nissan Leaf and Chevy Volt drivers. (ARV-09-005)
- Coulomb technologies, Inc. (Chargepoint, Inc.) – Electric Vehicle Infrastructure deployment in metropolitan areas of California. (ARV-09-007)
- Clipper Creek, Inc. – Updates existing EV infrastructure to the new charging standard. (SAE-J1772) (ARV-10-001)
- City of Reedley – EVSE at school district facility. (ARV-10-004)
- EV Connect, Inc. – Install EVSE at Los Angeles Metropolitan Transit stations. (ARV-10-006)
- The Association of Bay Area Governments – Bay Area EV Corridor deployment of various levels of charging infrastructure. (ARV-10-032)
- Sacramento Municipal Utility District – Charging infrastructure for plug-in hybrids and electric vehicle demonstration with General Motors. (ARV-10-034)
- Sacramento Municipal Utility District – Charging infrastructure for plug-in hybrid and electric vehicle demonstration with Chrysler. (ARV-10-041)
- Southern California Regional Collaborative – EVSE at various locations. (ARV-10-045)
- University of California, Irvine – EVSE on campus. (ARV-10-046)
- California Department of General Services – Upgrade EVSE at the Sacramento State Garage. (ARV-12-011)
- OurEvolution Energy and Engineering – Charging in Humboldt County. (ARV-12-012)
- Alternative Energy Systems Consulting, Inc. – Install fleet and workplace charging at UC San Diego. (ARV-12-013, ARV-12-020, and ARV-12-027)

- Aerovironment, Inc. – Install EVSE at fleet and residential venues. (ARV-12-016, ARV-12-017, and ARV-12-023)
- Joe Carlson Studio – Commercial building chargers. (ARV-12-019)
- Schneider Electric USA, Inc. – Charging at American Red Cross and San Mateo Community College. (ARV-12-038 and ARV-12-039)
- Los Angeles Department of Water and Power – Install fleet and workplace chargers. (ARV-12-051 and ARV-12-065)
- Green Charge Networks, LLC – DC Fast Chargers. (ARV-12- 052)
- South Coast Air Quality Management District – DC Fast Chargers. (ARV-12-053)

This strategic network of EVSE is providing the groundwork for a deployment that will support charging needs in diverse areas throughout California as depicted in **Tables 1 and 2**. This network will be coordinated with the EVSE that will be installed as part of the recent NRG Energy, Inc. (NRG) settlement and various local governmental agencies. The NRG Settlement with the California Public Utilities Commission is a $120 million agreement under which NRG will pay the State of California $20 million in cash and invest approximately $100 million over four years to build PEV charging infrastructure in California. Included in the agreement is 1) $40 million for 10,000 “make ready” units where EVSE can be installed in at least 1,000 multi-family, workplace and public facility locations, 2) $50.5 million for a minimum of 200 fast chargers called Freedom Stations owned and operated by NRG in four major metropolitan areas, and 3) $9 million in advanced EV charging technology and EV car sharing programs.[3] By leveraging these activities, the Energy Commission will be able to reach a more diverse range of prospective EV users, throughout California. Detailed information on individual projects can be found at: www.energy.ca.gov/drive/projects/electric.html .

Also, major auto manufacturers such as Tesla Motors and Nissan Motor Company are developing strategic networks of EVSE to support their customer’s needs. Tesla Motors is rolling out a network of Tesla Superchargers and battery swapping stations that will allow vehicle owners to recharge their vehicles along the major travel corridors throughout California. Nissan is continuing to expand a series of EVSE at Nissan dealerships throughout the state as a service to its customers. Currently, Nissan has over 90 participating dealerships throughout California. The Energy Commission recently funded Green Charge Networks smart grid fast chargers in partnership with convenience stores. These fast chargers incorporate an energy management system which reduces demand charges for the convenience store and mitigates on-peak energy use by providing battery storage for the fast chargers.

[3] http://www.cpuc.ca.gov/NR/rdonlyres/CD5E3578-5EAD-47BA-BC5A-B6BD398CCBF6/0/JointOfferofSettlement.pdf

Table 1: Currently Installed Level 1 & Level 2 EVSE Funded Through the ARFVTP by Recipient

Region	Installed EVSE
ANTELOPE VALLEY AQMD	5
BAY AREA AQMD	796
EL DORADO COUNTY AQMD	5
KERN COUNTY APCD	1
MENDOCINO COUNTY AQMD	1
MOJAVE DESERT AQMD	1
MONTEREY BAY UNIFIED APCD	64
NORTHERN SIERRA AQMD	1
NORTHERN SONOMA COUNTY APCD	2
PLACER COUNTY APCD	23
SACRAMENTO METROPOLITAN AQMD	189
SAN DIEGO COUNTY APCD	1,163
SAN JOAQUIN VALLEY UNIFIED APCD	14
SAN LUIS OBISPO COUNTY APCD	9
SANTA BARBARA COUNTY APCD	41
SOUTH COAST AQMD	861
VENTURA COUNTY APCD	97
YOLO-SOLANO AQMD	65
Region/Location Being Verified	1,052
Total	**4,390**

Note: “APCD” is Air Pollution Control District and “AQMD” is Air Quality Management District.

Source: California Energy Commission

Table 2: Additional Planned Level 1 & Level 2 EVSE Funded Through ARFVTP

Region	Planned EVSE
BAY AREA AQMD	156
EL DORADO APCD	6
MONTEREY BAY UNIFIED APCD	52
MOJAVE DESERT APCD	22
NORTH COAST UNIFIED AQMD	2
SACRAMENTO METROPOLITAN AQMD	35
SAN DIEGO COUNTY APCD	1,002
SAN JAOQUIN VALLEY APCD	3
SANTA BARBARA COUNTY AQMD	6
SOUTH COAST AQMD	377
TUOLUMNE COUNTY APCD	2
VENTURA COUNTY APCD	5
YOLO/SOLANO APCD	1
Location to Be Determined	1,021
TOTAL	**2,690**

Source: California Energy Commission

The ARFVTP supports the development of fast charging stations that can significantly decrease the amount of time necessary to charge an electric vehicle. Depending on the size of the vehicle's battery pack and state of charge, fast chargers will allow a driver to regain a majority of the charge in approximately 20 to 30 minutes. These chargers will help alleviate concerns with the driving range of full battery electric vehicles. With the current group of projects, ARFVTP funding will install a total of 77 DC fast chargers. Five DC fast chargers have been installed in San Diego as a result of ARFVTP funding. An additional 72 ARFVTP funded fast charging stations are planned to be installed by 2015 throughout the state as shown in **Table 3**.

Table 3: Additional Planned DC Fast Charging Stations Funded Through ARFVTP

	DC Fast Charging Infrastructure by Funding Recipient					
Region	**ABAG**	**Alternative Energy Systems Consulting**	**Ecotality**	**Green Charge Networks**	**SCAQMD**	**Total**
SAN DIEGO COUNTY APCD		3	15	3		**21**
SOUTH COAST AQMD				13	20	**33**
BAY AREA AQMD	16					**16**
MONTEREY BAY UNIFIED APCD	1					**1**
YOLO/SOLANO AQMD	1					**1**
Total By Recipient	**18**	**3**	**15**	**16**	**20**	**72**

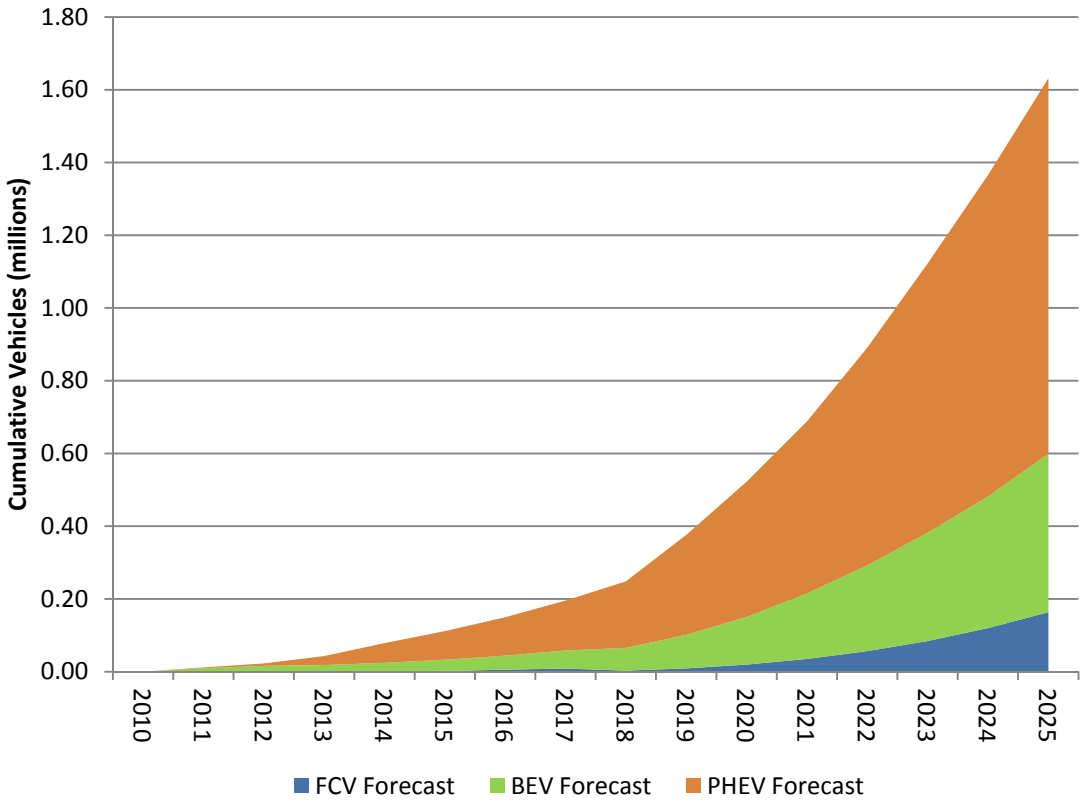
Source: California Energy Commission

Plug-in Electric Vehicles

Energy Commission staff estimate as of June 2013 there are over 32,000 PEVs and over 14,000 neighborhood electric vehicles on the roads. Sales of the new generation of plug-in hybrid electric vehicle (PHEV) started in December 2010 and since then over 28,000 of these vehicles have been purchased in California. The primary incentives for the sale of these vehicles in California came from both the Air Resources Board's Clean Vehicle Rebate Project (CVRP) and the federal tax credit for electric vehicles. **Figure 1** illustrates the 2011 IEPR Energy Commission forecasted cumulative sales of BEV, PHEV, and fuel cell vehicles (FCV) in California through 2020.[4]

4. Figure 1 incorporates vehicles from CED 2011 Low Electricity Demand Scenario and ARB most-likely FCV. Kavalec, Chris, Nicholas Fugate, Tom Gorin, Bryan Alcorn, Mark Ciminelli, Asish Gautam, Glen Sharp, and Kate Sullivan. 2012. *California Energy Demand Forecast 2012-2022 Volume 1: Statewide Electricity Demand and Methods, End-User Natural Gas Demand, and Energy Efficiency*. California Energy Commission, Electricity Supply Analysis Division. Publication Number: CEC-200-2012-001-CMF-VI. p. 39.

Figure 1: Forecasted Zero Emission Vehicle Sales



Sources: 2011 California Energy Demand Forecast, California Department of Motor Vehicle California Vehicle Registration Database, estimates from the Air Resources Board CVRP, and statewide sales trends.

Since almost all plug-in vehicles will be used to meet the zero emissions regulatory requirements, regulatory compliance will be monitored through yearly auto manufacturer reporting as required under the regulations. Dealer sales and leases in California are tracked by the manufacturer. The Air Resources Board will use aggregated data reported by the manufacturers to produce annual reports of compliance progress. Auto manufacturers failing to meet the requirements would be subject to substantial financial penalties.

A number of ancillary activities are also underway to facilitate deployment and prepare the infrastructure needed for the expanded use of plug-in electric vehicles in California:

- The California Public Utilities Commission has an alternative fueled vehicle proceeding to establish policies to overcome barriers to plug-in vehicle deployment consistent with Senate

Bill 626 (Kehoe, Chapter 355, Statutes of 2009). Topics to be addressed include rates, metering and consumer education regarding the benefits of time-of-use rates.

- The Statewide Plug-in Vehicle Collaborative, an ad hoc group of high-level stakeholders, is helping to facilitate and promote the deployment of vehicles in California. This collaborative has prepared a strategic plan called *Taking Charge: Establishing California Leadership in the Plug-in Electric Vehicle Marketplace.*

- The Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program prepares an investment plan each year to guide distribution of funding for alternative fuel and vehicle technologies, including plug-in vehicle infrastructure. The Energy Commission has funded ten regional plug-in electric plans facilitated by multi-agency Coordinating Councils to assist them in developing regional plug-in strategic plans for the deployment of EVSE, also known as charging stations. Six of these ten regions also received funds from the U.S. Department of Energy to streamline the permitting, installation and inspection processes for EVSE, establish best practices for "PEV ready" building and public works guidelines and provide consumer PEV education and outreach.

- The Energy Commission, with assistance from the National Renewable Energy Laboratories, will develop a Statewide Plug-in Electric Vehicle Infrastructure Plan to provide guidance on state level policy, high-priority locations for infrastructure, consideration of interregional corridors, and guidance to local communities and regions as they plan for plug-in electric vehicles.

Additional References:

For more information about the California Public Utilities Commission alternative vehicle proceeding see this link: www.cpuc.ca.gov/PUC/hottopics/1Energy/090814_ev.htm

TAKING CHARGE: Establishing California Leadership in the Plug-In Electric Vehicle Marketplace can be found at: www.evcollaborative.org/strategic-plan

For information on American Recovery and Reinvestment Act of 2009 projects for plug-in infrastructure development, see the *2010 Integrated Energy Policy Report Update*, www.energy.ca.gov/2010_energypolicy/index.html.

For more information on the AB 118 program, see: www.energy.ca.gov/drive/technology/plugin_electric.html and www.energy.ca.gov/2010-ALT-1/index.html

California Air Resources Board buying guide for clean and efficient vehicles: www.driveclean.ca.gov/

Clean Vehicle Rebate Project, Center for Sustainable Energy: energycenter.org/index.php/incentive-programs/clean-vehicle-rebate-project

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